

I claim:

1. A polishing fluid useful for polishing tantalum-containing barrier materials of a semiconductor substrate comprising:

a nitrogen-containing compound having at least two nitrogen atoms comprising at least one of a compound of a formula selected from the group comprising:

imine compounds $R^1 - C = NH$ (I)

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R^2

and hydrazine compounds $R^3R^4N - N R^5R^6$ (II),

wherein R^1 comprises -H or -NH₂ and R^2 , R^3 , R^4 , R^5 and R^6 independently comprise substituents selected from the group consisting of -H, a hydrocarbon group, an amino group, a carbonyl group, an imido group, an azo group, a cyano group, a thio group, a seleno group and -OR⁷ where R⁷ comprises a hydrocarbon group, and the nitrogen-containing compound being free of electron-withdrawing substituents; and the polishing fluid being capable of removing the tantalum-containing barrier materials from a surface of the semiconductor substrate without an abrasive.

2. The polishing fluid of claim 1, wherein the polishing fluid has 0 to 5 weight percent abrasive particles.

3. The polishing fluid of claim 1, wherein the nitrogen-containing compound contains the imine compound.

4. The polishing fluid of claim 1, wherein the nitrogen-containing compound contains the hydrazine compound.

5. A polishing fluid useful for polishing tantalum-containing barrier materials of a semiconductor substrate comprising:

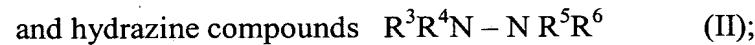
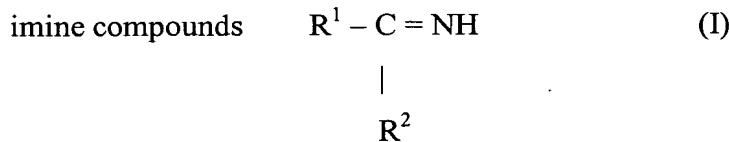
0 to 6 inhibitor for reducing the removal of an interconnect metal;

0 to 1 weight percent abrasive particles;

0 to 25 oxidizing agent;

0 to 15 complexing agent and

0.05 to 25 nitrogen-containing compound having at least two nitrogen atoms comprising at least one of a compound of a formula selected from the group comprising:



wherein R^1 comprises -H or -NH₂ and R^2 , R^3 , R^4 , R^5 and R^6 independently comprise substituents selected from the group consisting of -H, a hydrocarbon group, an amino group, a carbonyl group, an imido group, an azo group, a cyano group, a thio group, a seleno group and -OR⁷ where R^7 comprises a hydrocarbon group, and the nitrogen-containing compound having an electron-donating substituent; and the polishing fluid being capable of removing the tantalum-containing barrier materials from a surface of the semiconductor substrate without an abrasive.

6. The polishing fluid of claim 5, wherein the polishing fluid contains no abrasive particles.

7. The polishing fluid of claim 5, wherein the nitrogen-containing compound contains the imine compound and the imine compound contains at least one selected from at least one of the group comprising 1,3-diphenyl guanidine, guanidine hydrochloride, tetramethylguanidine, formamidine acetate and acetamidine hydrochloride.

8. The polishing fluid of claim 5, wherein the nitrogen-containing compound contains the hydrazine compound and the hydrazine compound contains at least one selected from at least one of the group comprising carbohydrazide, imidazole, acetic hydrazide, semicarbazide hydrochloride, and formic hydrazide.

9. A method for polishing a semiconductor substrate, the semiconductor substrate having a metal interconnect layer and a tantalum-containing barrier layer adjacent the metal interconnect layer comprising:
polishing a barrier layer with a polishing fluid to remove at least a portion of the tantalum-containing barrier layer, the polishing fluid being abrasive-free and comprising a nitrogen-

containing compound having at least two nitrogen atoms comprising at least one of a compound of a formula selected from the group comprising:



wherein R^1 comprises -H or $-\text{NH}_2$; and R^2 , R^3 , R^4 , R^5 and R^6 independently comprise substituents selected from the group consisting of -H, a hydrocarbon group, an amino group, a carbonyl group, an imido group, an azo group, a cyano group, a thio group, a seleno group and $-\text{OR}^7$ where R^7 comprises a hydrocarbon group, and the nitrogen-containing compound being free of electron-withdrawing substituents.

10. The method of claim 9 wherein the tantalum-containing barrier layer contains tantalum or tantalum-nitride and the polishing removes at least a portion of the tantalum-containing barrier layer.